

**WHAT IS CLAIMED IS:**

1. A substrate construction for immobilizing a physiological material comprising:

a substrate;

an organic polymer linker material layer formed on the substrate; and

a gold thin layer formed on the organic polymer linker material layer, wherein the organic polymer linker material layer has a thickness ranging from 30 to 200nm and shows peaks of 111 and 200 planes using X-ray diffractometry when the X-rays radiate at an incident angle of 1.5.

2. The substrate construction according to claim 1, wherein the substrate is selected from the group consisting of glass, polycarbonate, polyester, polyethylene, polypropylene, and wafer.

3. The substrate construction according to claim 1, wherein one terminal end of the organic polymer linker material has a functional group that is capable of reacting with a functional group of the substrate and another terminal end has a functional group with a positive charge that is capable of undergoing ionic interaction with a negative charge of a gold colloid surface.

4. The substrate construction according to claim 1, wherein the organic polymer linker material is represented by the formula:

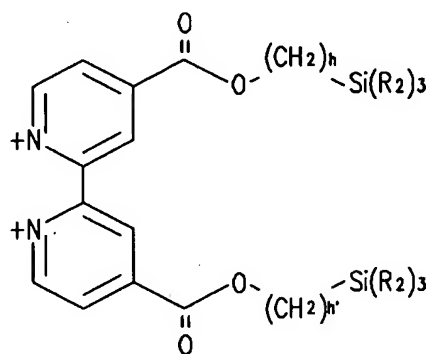


where X is a functional group having a positive charge that is capable of undergoing ionic interaction with a negative charge of a gold colloid surface,  $R_1$  is a spacer of  $(CH_2)_n$  or  $(CH_2)_n$  having one or more carboxyl or imino groups replacing one or more of the ethylene monomers, where n is an integer from 1 to 8, and  $Si(R_2)_3$  is a functional group that is capable of reacting with functional groups on the substrate surface where each  $R_2$  is independently selected from the group consisting of alkoxy groups, halides, and aldehyde groups.

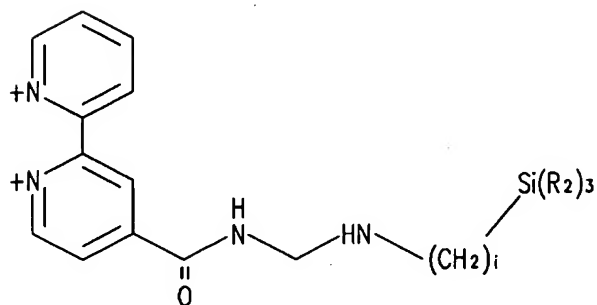
5. The substrate construction according to claim 1, wherein the functional group with a positive charge is an imine group.

6. The substrate construction according to claim 5, wherein the functional group with a positive charge is a functional group having at least two imine groups.

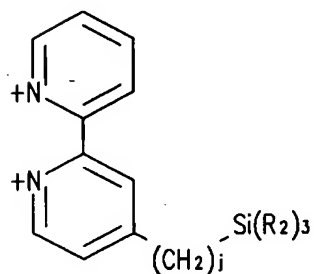
7. The substrate construction according to claim 3, wherein the organic polymer linker material is selected from the group consisting of a viologen-based compound having a formula selected from (2a), (2b) and (2c), a polymer having an imine-group-containing polyethylene backbone having formula (3), a compound having formula (4) and a compound having formula (5):



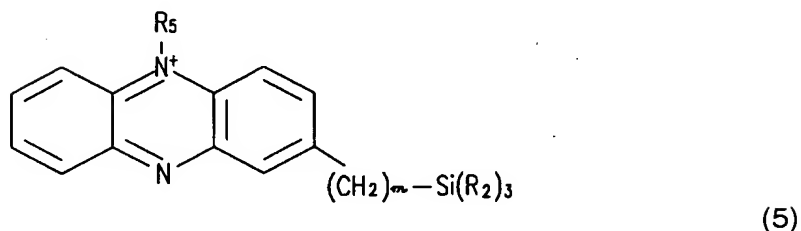
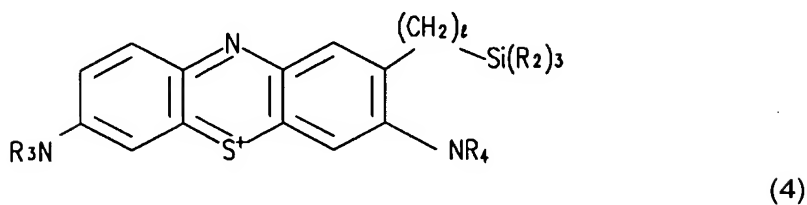
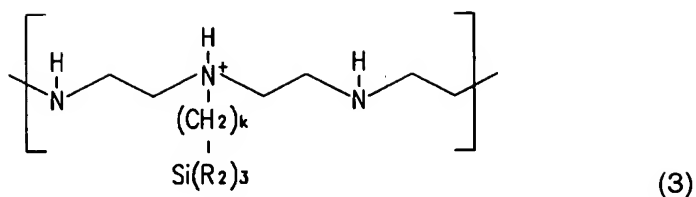
(2a)



(2b)

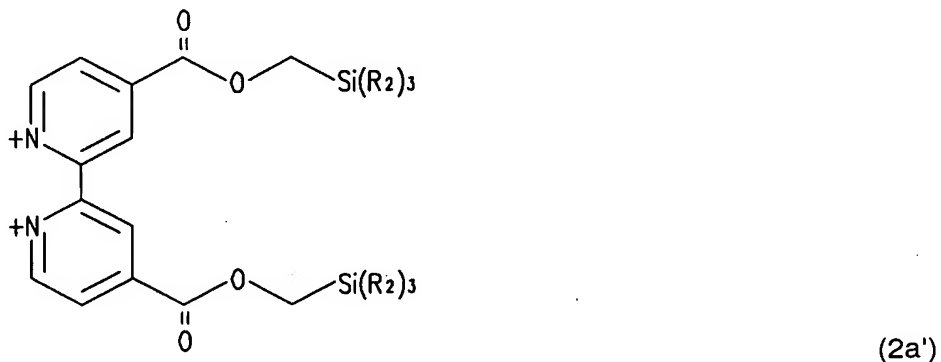


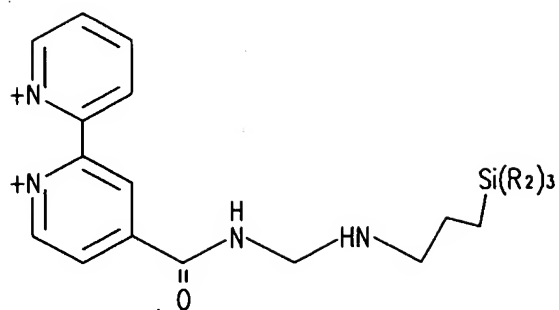
(2c)



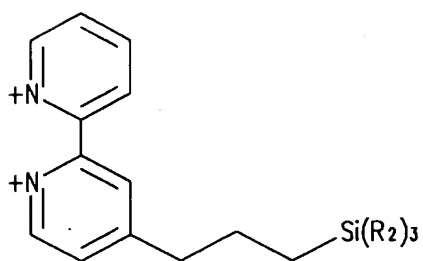
where each  $\text{R}_2$  is independently selected from the group consisting of alkoxy groups, halides, and aldehyde groups;  $h$ ,  $h'$ ,  $l$  and  $m$  are integers from 1 to 8;  $\text{R}_3$  and  $\text{R}_4$  are independently  $(\text{R}_6)_2$  where  $\text{R}_6$  is a halogen or a  $\text{C}_1$  to  $\text{C}_6$  alkyl; and  $\text{R}_5$  is a halogen or a  $\text{C}_4$  to  $\text{C}_6$  alkyl.

8. The substrate construction according to claim 7, wherein the organic polymer linker material is selected from the group consisting of a compound having a formula selected from (2a'), (2b') or (2c'), a polymer having formula (3'), a methylene bule compound having formula (4') and a phenazine methosulphate compound having formula (5'):

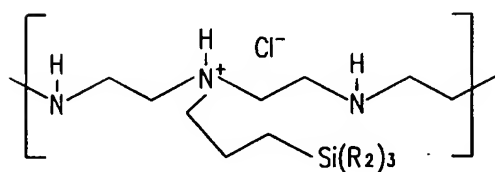




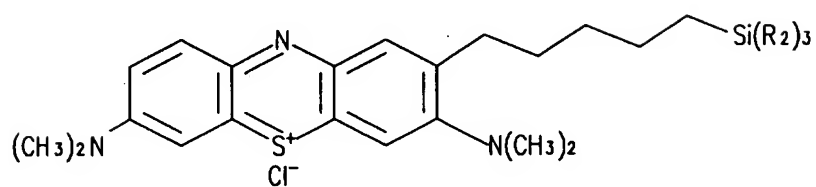
(2b')



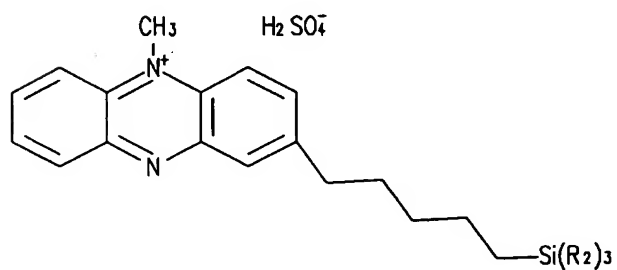
(2c')



(3')



(4')



(5')

where each  $R_2$  is independently selected from the group consisting of alkoxy

groups, halides and aldehyde groups.

9. The substrate construction according to claim 6, wherein the organic polymer linker material comprises trimethoxysilylpropyl polyethyleneimine.

10. A biochip comprising a physiological material immobilized on a surface of the substrate according to claim 1.

11. A biochip according to claim 10, wherein the physiological material is selected from the group consisting of enzymes, proteins, DNA, RNA, microbes, microorganisms, animal and plant cells and organs, and neurons.

12. A method of fabricating a substrate construction for immobilizing a physiological material comprising:

forming an organic polymer linker material layer by coating a coating composition including organic polymer linker material on a substrate;

forming a seed colloid catalytic layer by coating a gold colloid dispersion on the organic polymer linker material layer;

drying or heat-treating the substrate on which the seed colloid catalytic layer is formed; and

applying a coating composition comprising a gold salt-containing aqueous solution and a reducing agent-containing solution to form a gold thin layer.

13. The method according to claim 12, wherein one terminal end of the organic polymer linker material has a functional group that is capable of reacting with a functional group of the substrate and another terminal end has a functional group with a positive charge that is capable of undergoing ionic interaction with a negative charge of a gold colloid surface.

14. The method according to claim 12, wherein the organic polymer linker material is represented by the formula:

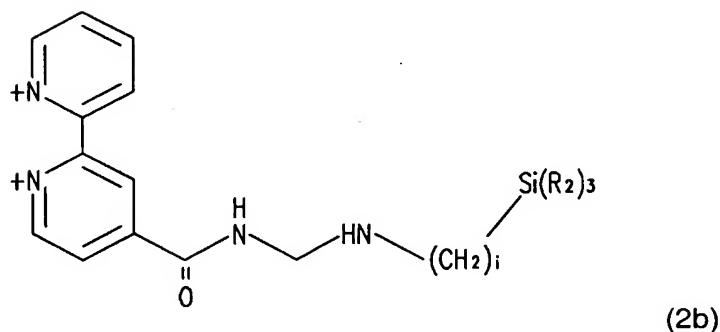
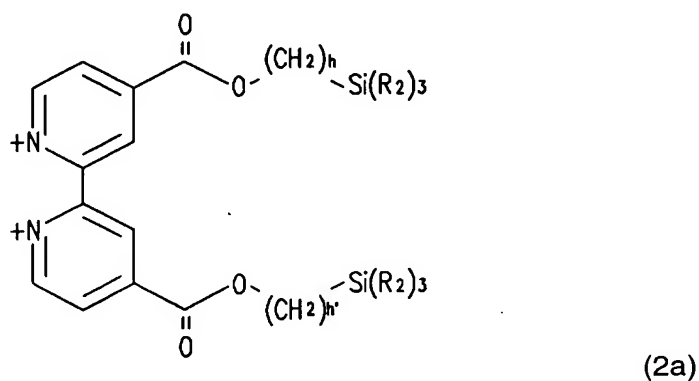


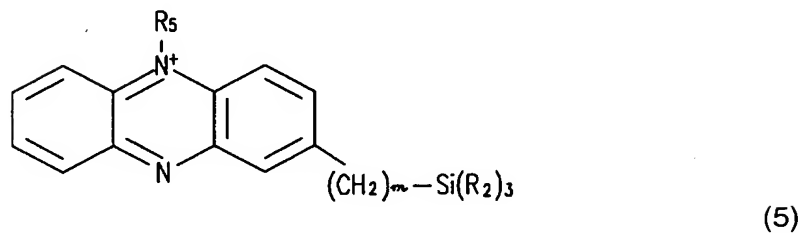
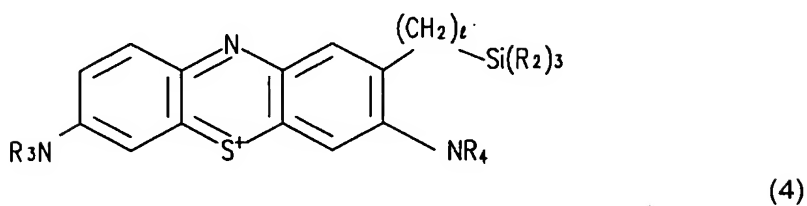
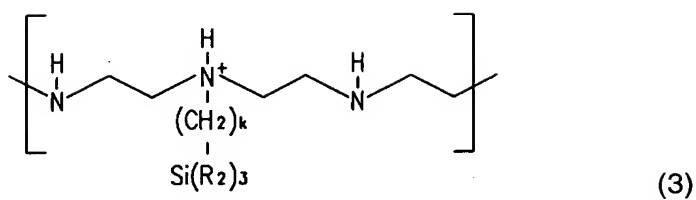
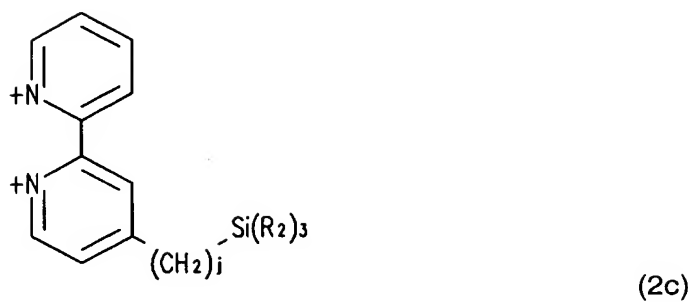
where X is a functional group having a positive charge that is capable of undergoing ionic interaction with a negative charge of a gold colloid surface,  $R_1$  is a spacer of  $(CH_2)_n$  or  $(CH_2)_n$  having one or more carboxyl or imino groups replacing one

or more of the ethylene monomers, where  $n$  is an integer from 1 to 8, and  $\text{SiR}_2$  is a functional group that is capable of reacting with functional groups on the substrate surface where each  $\text{R}_2$  is independently selected from the group consisting of alkoxy groups, halides, and aldehyde groups.

15. The method according to claim 13, wherein the functional group with a positive charge is an imine group.

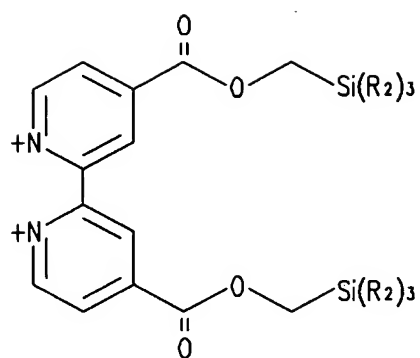
16. The method according to claim 13, wherein the organic polymer linker material is selected from the group consisting of a viologen-based compound having a formula selected from (2a), (2b) and (2c), a polymer having an imine group-containing polyethylene backbone having formula (3), a compound having formula (4) and a compound having formula (5):



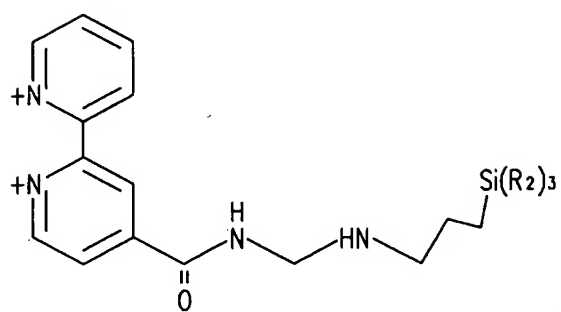


where each  $R_2$  is independently selected from the group consisting of alkoxy groups, halides, and aldehyde groups;  $h$ ,  $h'$ ,  $l$  and  $m$  are integers from 1 to 8;  $R_3$  and  $R_4$  are independently  $(R_6)_2$  where  $R_6$  is a halogen or a  $C_1$  to  $C_6$  alkyl; and  $R_5$  is a halogen or a  $C_4$  to  $C_6$  alkyl.

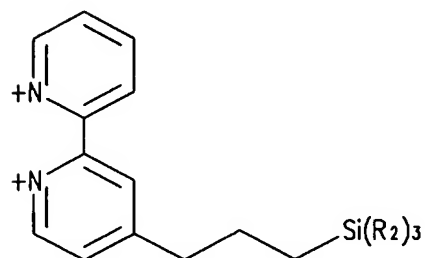
17. The method according to claim 16, wherein the organic polymer linker material is selected from the group consisting of a compound having a formula selected from (2a'), (2b') and (2c'), a polymer having formula (3'), a methylene blue compound having formula (4') and a phenazine methosulphate compound having formula (5'):



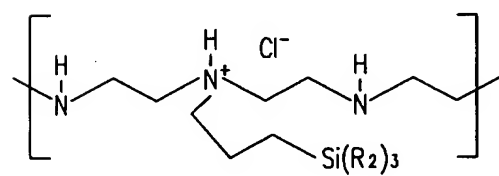
(2a')



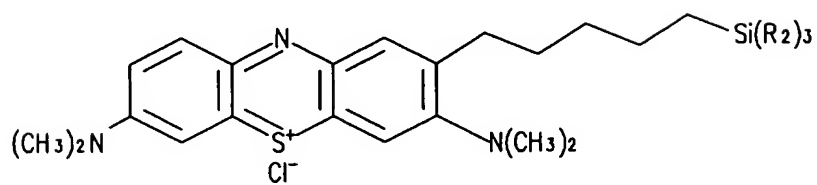
(2b')



(2c')

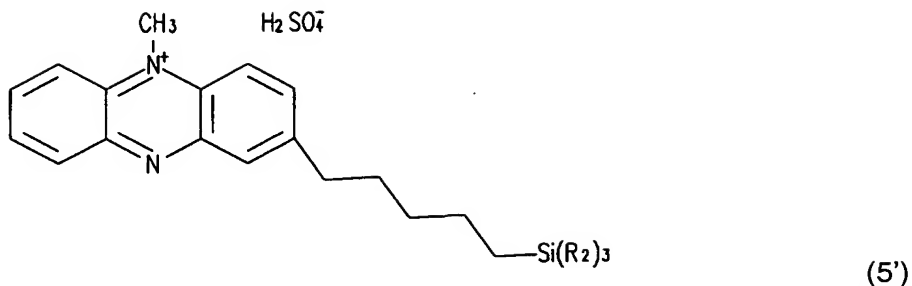


(3')



(4')





where each  $R_2$  is independently selected from the group consisting of alkoxy groups, halides and aldehyde groups.

5            18.      The method according to claim 13, wherein the organic polymer linker material comprises trimethoxysilylpropyl polyethyleneimine.

19.      The method according to claim 12, wherein the organic polymer linker material is used in an amount of 0.01 weight % to 50 weight % based on the coating composition.

10           20.      The method according to claim 12, wherein the organic polymer linker material is coated using a coating method selected from the group consisting of self-assembly thin layer coating, spin-coating, dipping, spraying, printing, and a Langmuir Blodgett Technique.

15           21.      The method according to claim 12, wherein the seed colloid catalytic layer comprises gold colloid having a particle size ranging 5nm to 500nm.

22.      The method according to claim 12, wherein the gold colloid dispersion comprises gold salt, a reducing agent, a stabilizer and a solvent.

23.      The method according to claim 22, wherein the gold salt is selected from the group consisting of  $\text{HAuCl}_4$ ,  $\text{NaAuCl}_4$ , and mixtures thereof.

20           24.      The method according to claim 22, wherein the reducing agent is selected from the group consisting of  $\text{NaBH}_4$ , thiocyanate, potassium carbonate, trisodium citrate or hydrate thereof, tannic acid, hydroxyamine or a salt thereof, and

mixtures thereof.

25. The method according to claim 22, wherein the stabilizer comprises sodium citrate.

5 26. The method according to claim 12, wherein the coating method of the seed catalytic layer is selected from the group consisting of dipping, spraying, spin-coating, and printing.

27. The method according to claim 12, wherein the gold salt-containing aqueous solution comprises a gold salt selected from the group consisting of  $\text{HAuCl}_4$ ,  $\text{NaAuCl}_4$ , and mixtures thereof.

10 28. The method according to claim 12, wherein the gold salt-containing aqueous solution comprises 0.01 weight % to 20 weight % of a gold salt.

15 29. The method according to claim 12, wherein the reducing agent of the reducing agent-containing solution is selected from the group consisting of  $\text{NaBH}_4$ , thiocyanate, potassium carbonate, trisodium citrate or hydrate thereof, tannic acid, hydroxyamine or a salt thereof, and mixtures thereof.

30. The method according to claim 12, wherein the reducing agent-containing solution comprises 0.01mM to 1M of a reducing agent.

31. The method according to claim 30, wherein the reducing agent-containing solution comprises 0.01mM to 100mM of a reducing agent.

20 32. The method according to claim 12, wherein the coating of the gold thin layer is performed using a plating method.